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Observation of computer-supported, collaborative work tool usage during briefing and debriefing phases of coalition mission training research for Maple Skies 05/06

by:

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Abstract

The Coalition Mission Training Research (CMTR) Computer-Supported, Collaborative Work (CSCW) system allows geographically separated participants to collaborate during mission planning and briefing/debriefing. Collaboration within the CMTR environment is focused on facilitating task-oriented communication among team members. The opportunity was taken to conduct a video analysis and questionnaire survey of participants in a distributed briefing and debriefing environment during the Maple Skies simulation training event. The video analysis focused on behaviours exhibited by participants such as how many turns they had, how long each phase of the briefing lasted, collaborative tool use, gestures, and interruptions. The questionnaire survey solicited a participant's feelings on how well the collaborative tools facilitated the distributed briefings and debriefings. The results of these investigations are reported and recommendations for future development of this work are made.

Résume

Le système de travail coopératif assisté par ordinateur (CSCW) des recherches sur l'instruction en vue de missions de la coalition (CMTR) permet aux participants éloignés géographiquement de collaborer durant la planification de missions et le breffage/ débreffage. La collaboration en milieu CMTR met l'accent sur les moyens de faciliter les communications orientées sur les tâches entre les membres d'équipe. Il s'est présenté une occasion de mener une analyse vidéo et un sondage au moyen d'un questionnaire auprès des intervenants dans un milieu de breffage et de débreffage réparti durant l'exercice d'instruction de simulation Maple Skies. L'analyse vidéo a porté sur les comportements manifestés par les intervenants, comme le nombre de fois où ils sont intervenus, la durée de chaque phase de breffage, l'utilisation d'outils de collaboration, les gestes et les interruptions. Le sondage par questionnaire demandait aux intervenants à quel degré les outils de collaboration facilitaient les breffages et les débreffages répartis. Les résultats des enquêtes sont signalés, et des recommandations sont présentées à l'égard de la poursuite ultérieure des travaux.

Executive Summary

The Simulation and Modelling for Acquisition, Rehearsal and Training (SMART) group at Defence Research and Development Canada (DRDC) Toronto have a remit to research distributed simulation for the purposes of training. Part of this remit is the consideration of computer supported collaborative working. As part of this program of research, a simulation (called 'Maple Skies') was held between 22nd and 24th February 2006. This simulation was originally intended to involve the US Air Force and other Canadian units in a distributed environment that would involve flying the mission, but also online collaborative briefing and debriefing. To facilitate this, the Coalition Mission Training Research (CMTR) Computer-Supported Collaborative Work (CSCW) system allows geographically separated participants to collaborate during mission planning and briefing/debriefing. Collaboration within the CMTR environment is focused on facilitating task-oriented communication among team members. Due to technical difficulties, the other participants withdrew from the activity, but DRDC Toronto continued with the simulation and created a distributed team by which to investigate online collaboration.

Two approaches were followed: video analysis and questionnaire surveys. The questionnaire surveys collected data about the participants' level of comfort with common computer applications and computer use. The video analysis collected data concerning one-to-many and many-to-many communication measures. One-to-many communication measures included overall session time, mission briefing and debriefing phase times, and frequency and duration of technical breakdowns. Many-to-many communication measures included CSCW tools used, number of turns for each participant, number of active participants, transitions between participants, and incidence of overlaps between participants. In total there were up to 10 participants, although only four completed the surveys.

Analysis showed that the mission briefing and debriefing format were rigidly structured and controlled by the mission commander. There was little interruption or questioning by other participants. The mission commander had the most turns and the longest speaking durations. Few technical breakdowns were observed and all participants replied that they were comfortable with using computers.

The investigation was observational in nature and thus no control was exerted over the situations in which participants found themselves. This resulted in data from which it is difficult to draw conclusions. Nevertheless, this investigation did result in a number of recommendations regarding how the investigation could result in more information outcomes if performed again. What conclusions could be drawn and the recommendations for future work are discussed.

Sommaire

Le groupe de simulation et de modélisation pour l'acquisition, la répétition et l'entraînement (SMARE) de Recherche et Développement pour la défense Canada (RDDC) Toronto a le mandat de mener des recherches sur la simulation répartie aux fins d'instruction. Ce mandat comprend notamment l'examen du travail coopératif assisté par ordinateur (CSCW). Dans le cadre du programme de recherche, un exercice de simulation (appelé « Maple Skies ») a eu lieu du 22 au 24 février 2006. L'exercice reposait au départ sur la participation de la US Air Force et d'unités du Canada dans un milieu réparti, qui supposait l'exécution de la mission en vol, mais aussi la tenue de breffage et de débreffage en ligne. À cette fin, le système CSCW des recherches sur l'instruction en vue de missions de la coalition (CMTR) permet aux participants éloignés géographiquement de collaborer durant la planification de missions et le breffage/débreffage. La collaboration en milieu CMTR met l'accent sur les moyens de faciliter les communications orientées sur les tâches entre les membres d'équipe. À cause de difficultés techniques, les autres participants se sont retirés de l'activité, mais RDDC Toronto a poursuivi la simulation et créé une équipe répartie chargée d'étudier la collaboration en ligne.

Deux approches ont été adoptées : l'analyse vidéo et un sondage au moyen d'un questionnaire. Le sondage par questionnaire a permis de recueillir des données sur le niveau d'aisance des participants avec des applications informatiques courantes et l'utilisation d'un ordinateur. L'analyse vidéo a permis de recueillir des données sur les communications d'un à plusieurs et de plusieurs à plusieurs. Les données de communications d'un à plusieurs comprenaient la durée globale des séances, la durée des phases de breffage et de débreffage de la mission, ainsi que la durée et la fréquence des avaries techniques. Les données de communications de plusieurs à plusieurs comprenaient les outils CSCW utilisés, le nombre d'interventions de chaque participant, le nombre de participants actifs, les transitions entre les participants et l'incidence des chevauchements entre les participants. En tout, on a compté jusqu'à dix participants, même si seulement quatre ont pris part au sondage.

L'analyse a montré que le breffage et le débreffage de la mission étaient structurés selon un format rigide, dirigé par le commandant de mission. Il y a eu peu d'interruptions ou de questions des autres participants. C'est le commandant de mission qui a fait le plus d'interventions et avait la parole le plus souvent. Peu d'avaries techniques ont été observées, et tous les participants ont indiqué se sentir à l'aise à utiliser un ordinateur.

L'enquête reposait sur des observations, ce qui veut dire qu'aucun contrôle n'a été exercé sur les situations dans lesquelles les participants se sont trouvés. Cela explique qu'on a obtenu des données à partir desquelles il est difficile de tirer des conclusions. Cette enquête s'est néanmoins traduite par un certain nombre de recommandations sur la façon dont l'enquête pourrait permettre d'obtenir plus d'information si elle était effectuée de nouveau. Les conclusions qui pourraient être tirées et les recommandations concernant des recherches futures sont examinées.

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1 Background

The Coalition Mission Training Research (CMTR) Computer-Supported, Collaborative Work (CSCW) system allows geographically separated participants to collaborate during mission planning and briefing/debriefing. Collaboration within the CMTR environment is focused on facilitating task-oriented communication among team members.

The CSCW system in the CMTR boardroom is a collection of hardware and software components that allow team members to present and share information in a timely manner. The components of the CMTR CSCW system are loosely coupled, with each component only providing a small subset of the required features/functions (some overlap between components and features exists). This definition differs from most of the CSCW systems (and related evaluations) found in the literature in that those systems are typically tightly coupled and in many cases, a single hardware/software package implements all of the features being evaluated. A federated CSCW system has the disadvantage that information and awareness are not easily shared or obtained between the components and there is a heavy reliance on the user to maintain a consistent situational and social awareness when switching between applications. Alternatively, the federated system approach has the advantage that components can easily be added or removed to tailor the overall feature set of the system in order to meet the team's communication and coordination (collaboration) needs.

The CMTR CSCW system at Defence Research and Development Canada (DRDC) Toronto currently consists of the following components:

1. SMART Board Interactive Whiteboard (www.smarttech.com)
2. Voice conferencing system
    a. VoIP Phones
3. Video conferencing system
    a. Polycom (www.Polycom.com)
4. Desktop computers – Windows NT/2000/XP
5. Desktop applications:
    a. PowerPoint
    b. Falcon View – flight plan viewer
    c. DCS – mission log viewer

The primary role of the CMTR CSCW system is to support collaboration between team members (pilots, ATC officers, etc) in a simulated air force mission environment. There are three high-level stages of an air force mission: planning, execution, and debriefing. The planning and debriefing stages are of interest because of the possible use of a CSCW system within these stages.

The planning stage can be divided into the following sub-stages: mission tasking, detailed flight plan development, and coordination briefing. During the mission tasking the overall mission plan is presented to all participants (also referred to as the Overview Briefing). During the flight plan development, individual participants are responsible for producing a flight plan that is constrained by the overall mission briefing and local factors (e.g., weather, war zones, and aircraft limitations). Once the individual flight plans are completed, a final briefing is presented which combines the individual flight plans. After this stage, all participants are appropriately tasked. Once the briefing is completed, the mission is flown (mission execution). Following the mission execution is the debriefing stage. A key result of the mission debriefing is the identification of lessons learned. The debriefing can be either a structured or an unstructured discussion of the team members' impressions of the mission execution. The discussion highlights both negative and positive aspects of the mission execution.

Therefore, the types of communication and coordination that the CMTR CSCW system must accommodate are diverse and the use of a federation of components may have merit in terms of supporting the communication needs of the team members but typically at the cost of coordination (distributed process loss).

Past research regarding the effectiveness of the CMTR CSCW system has primarily focused on Quality of Service and functional requirements issues. This has been accomplished by reviewing relevant data logs and by interviewing users after a session to elicit comments about the user's satisfaction of the various communication and collaboration tools. These results were than used as anecdotal evidence as to which tools should be replaced for future sessions.

These past studies have lead to a CSCW system that seems to meet the needs of the users but it is unclear as to what those needs are. Therefore, one of the primary motivations for this research is to understand the needs of the users of this CSCW environment. Along with understanding the user requirements, it is a goal of this research to produce a repository of collaboration patterns that can be used to analyze and evaluate other collaborative systems for military applications (e.g., mission planning, briefing, and debriefing). This repository of patterns is of particular importance as the Canadian Forces are a geographic dispersed military that require timely access to information thus the increasing importance on CSCW and groupware technologies. As the reliance on such technologies increases, the military will need an efficient means (selection criteria) to assist in the selection of various tools for different application environments. In addition to identifying patterns that need to be supported by a CSCW application, the tasks encapsulated in those patterns can be linked back to skills and training requirements in order to successfully perform/operate/work with the CSCW application.

A planned CMTR distributed simulation event, Maple Skies, was used to collect data on CSCW collaboration patterns. This simulation took place in the Simulated Environments Research Facility (SERF) at DRDC Toronto, and used the Multi-Task Trainer (MTT; a CF-18 simulator) and the associated Next Generation Threat Simulator (NGTS). Data was collected on video tape and via behavioural surveys. All data was subject to offline analysis once the CMTR event was concluded.

This work was performed under contract W7711-037871//001/TOR, call-up 7871-07. The Scientific Authority (SA) for this work was Dr. Rick Bodner.

2 Method

There were three main elements to this work: video data collection; behavioural survey data collection; and data analysis. Each element will be discussed separately below.

2.1 Video Data Collection

The planning, briefing, and debriefing activities were conducted in two rooms, both within the SERF, but located on different floors. The room normally used for flight planning and video conferences was downstairs. Upstairs, a shared office had been commandeered for the purposes of distributed planning. Because most collaborative tools were located downstairs, the focus of video data collection was downstairs. Upstairs, only one video camera was used to capture the whole room and all occupants. Downstairs, three video cameras were arranged in three corners of the room, supplemented by external microphones. This coverage was to ensure all behaviours were captured (see Figure 1). Additionally, the Polycom videoconferencing system was recorded to video tape to ensure that a 'primary' view was captured of both the downstairs and upstairs.

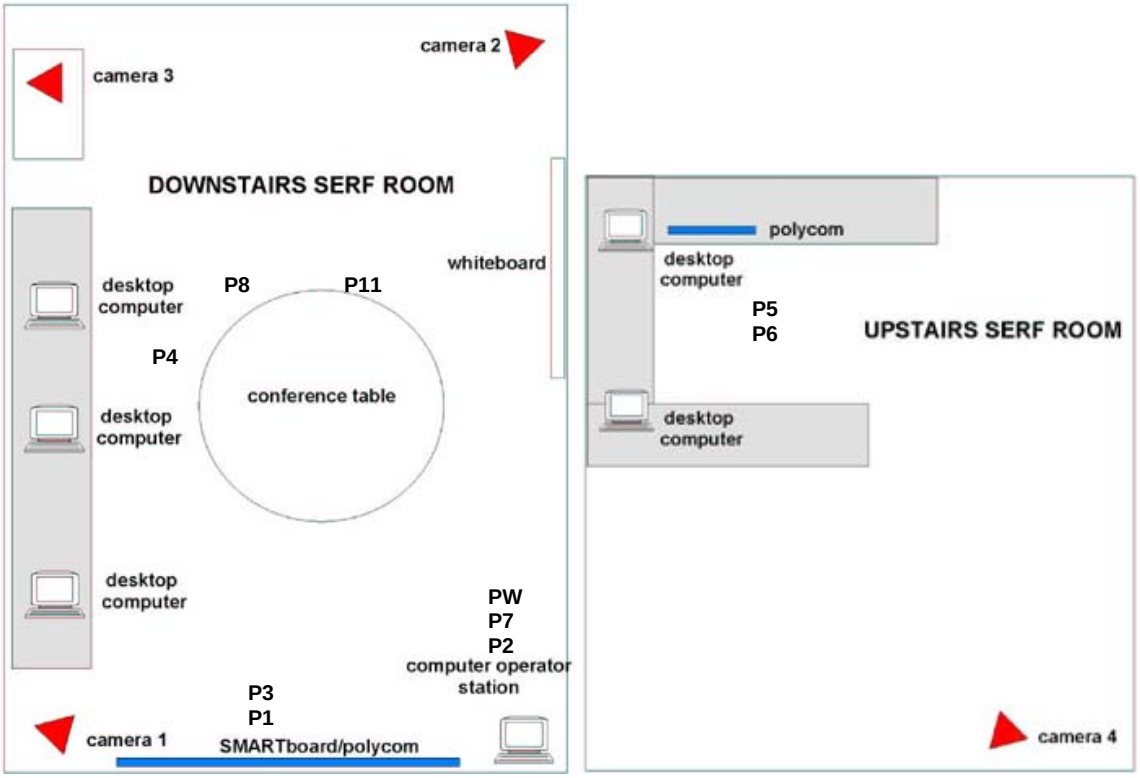

Figure 1: Room Layout, Typical Participant Positions and Data capture Configuration

The video capture devices used to collect the video data are presented in Table 1.

Table 1 : Video Capture Equipment

Item	Quantity
VIDEO CAMERAS	4
Sony TRV87 8mm camcorder (camera 2)	1
Sony TRV240 Digital8 camcorder (cameras 3 and 4)	2
Sony TRV110 Digital8 camcorder (camera 1)	1
RECORDER DECKS	2
JVC S-Video recorder (used with camera 3)	1
Sony 4-Head VCR (used with Polycom system)	1
VIDEO CONFERENCE SYSTEM	1
Polycom	1
MICROPHONES	2
Sony ECM-MS908C (used with cameras 1 and 2)	2

The CMTR event ran from Wednesday 22nd February to Friday 24th February, 2006. Each day consisted of at least one briefing and one debriefing. On some days, more than one briefing was captured. After each briefing and debriefing period, the video tape in each camera was replaced. All tapes were returned to DRDC Toronto for safe-keeping or destruction at the conclusion of this work.

2.2 Behavioural Survey Data Collection

Initially, the participants in this study were to be the CMTR event training audience (i.e. CF-18 pilots and airborne weapons controllers) and associated Subject Matter Experts (SMEs). Each participant was given a computer-experience questionnaire and a performance measurement questionnaire after each briefing and each debriefing. After review of these performance measurement questionnaires, it was decided to amalgamate them with the broader Measures of Performance (MOPs) questionnaire focusing on training effectiveness. The original questionnaire items are shown in Annex A-4 through to Annex A-25. The resultant questionnaire items are shown in Annex A-2 and Annex A-3. In total, six participants filled in behavioural surveys: two CF-18 pilots, two airborne weapons controllers, and two SMEs (both former CF-18 pilots).

2.3 Data Analysis

Upon conclusion of the CMTR event, the video taped data was transferred digitally to a non-linear editing system. The non-linear editing software application provided the means to obtain a synchronous time code across the five different recording devices and provide a process to accurately time stamp specific communication measures. The tapes were then reviewed and instances of particular behaviours were noted.

Additionally, relevant details were captured whenever there was a shift or change in the state of the session (e.g., pilots leave briefing room since their section of the brief has ended, group motivation waning do to technical difficulties, etc.). Behavioural survey responses were used to supplement

the data captured from the video record. With a small subject sample, it is not possible to do statistical testing on the survey data beyond simple descriptive statistics. The results of this data compilation will be reported in the next section.

2.4 Behaviour Notes

2.4.1 Social Parameters

The chair of the mission maintained loose control with a pre-determined agenda open to modification. No rules of order were used, but floor control was dictated by the agenda and a general understanding the chair (or moderator) was responsible for introducing each participant prior to each phase presentation. No official rank titles were used among the participants other than their call signs. All communication consisted of a combination of one-to-many and many-to-many exchanges and was public.

2.4.2 Group Characteristics

The group involved in the CSCW tool usage study consisted of the following participants: 2 airborne weapons controllers, 2 CF-18 pilots, 4 retired air force captains. Figure 2 represents the hierarchical breakdown and military status of the individuals involved with the study. Originally, the Canadian Forces Base (CFB) Bagotville and Air Force Research Laboratory (AFRL) Mesa were to participate in Maple Skies, but due to technical issues they were not involved.

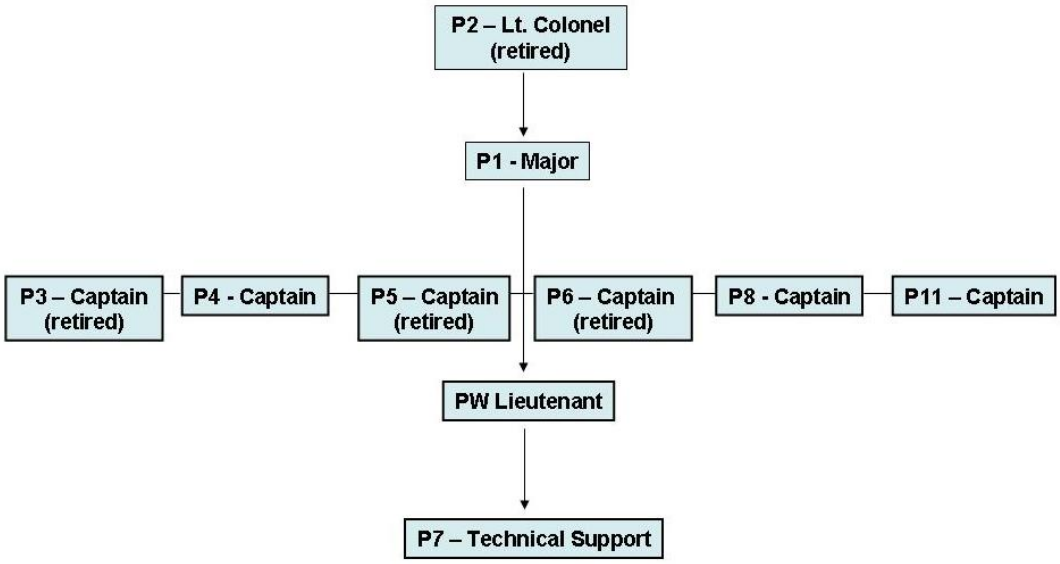

Figure 2: Hierarchical Representation of Rank of Participants

The number of members in total was 11 including one technical support person. The number of team members per location was not fixed and varied per mission and session. Two locations were used, both located in DRDC's Toronto SERF area. One room was located downstairs and one upstairs (refer to Figure 1.0 for room configuration). The group as a whole was newly formed, but the majority of the members were familiar with one another from previous engagements. The time allotted for each mission brief and debrief was to a maximum of 45 minutes.

2.4.3 Technology Characteristics

The groupware (hardware and software) available for the CSCW tool usage study at DRDC Toronto included:

- SMART Board Interactive Whiteboard (www.smarttech.com)
- Voice conferencing system - VoIP Phones
- Video conferencing system - Polycom (www.polycom.com)
- Desktop computers – Windows NT/2000/XP
- Desktop applications included:
    - Microsoft Office Suite (w/Power Point)
    - Falcon View – flight plan viewer
    - DCS – mission log viewer

The downstairs SERF room contained the SMART Board Interactive Whiteboard; a Polycom system; telephones; various desktop computers workstations; a presentation operator station; Microsoft Office applications; falcon view; and the DCS mission log viewer. The upstairs SERF room included a Polycom system; telephone; and 2 desktop computers with Microsoft Office. The downstairs SERF room employed a technology operator and the upstairs SERF room did not.

The minimum hardware requirements for a site to join the conference are a telephone line and telephone (dial-in to join the conference). Based on the minimum hardware requirements, no software is required.

3 Results

3.1 Measures of Performance

Due to the small sample size, only descriptive statistical techniques were used. The results of the Measures of Performance (MOP) data (see Figure 3; see pages A-4 – A-25 for the content of each MOP) shows a trend toward higher ratings (increased number of 4/5 ratings and higher overall averages) later in the exercise compared to early in the exercise. The Generic MOPs increased on average from 3.5 to 4.67 (greater than a 1 point increase). The higher ratings imply the quality of the briefing, execution and debriefing increased as the exercise progressed.

Possible reasons for the increase in quality observed by the SMEs could be attributed to the following learning effects:

- increased comfort levels in the DRDC Toronto environment
- increased productivity through familiarity of the individuals working together
- adaptation to the daily schedule
- perceived increase in quality by the SMEs when in fact there was no change

The Generic MOPs used behaviourally anchored rating scales (BARS) for each characteristic. Due to the relatively high ratings, it should be determined whether the pilots truly performed at the reported level or if the behavioural anchors affected the rating. If the latter is the case, recalibration of the behavioural anchors may be required.

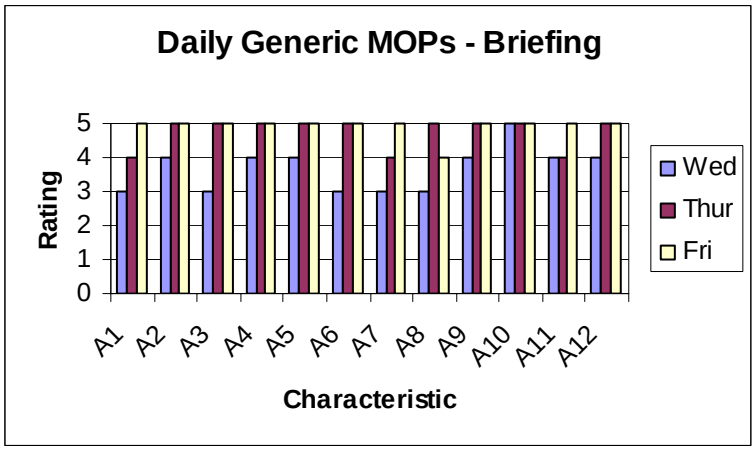

Figure 3: Daily Generic MOPs – Briefing

3.2 Questionnaires

The computer experience questionnaire (see Annex A-1) and the CSCW survey (see Annex A-2) were distributed to both the CF-18 pilots (P4 and P1) and the airborne weapons controllers (P11 and P8).

3.2.1 Computer Experience

The results of the questionnaire are presented in Table 2: below. Due to the small sample size (n=4), no statistical analyses were conducted. All the Computer Experience Questionnaire (CEQ) recipients had comparable computer experience reporting daily usage of computers and the Microsoft Office Suite software package. The majority of the participants stated high comfort levels with Microsoft Office software.

Table 2: Computer Experience

Question	AWACS		PILOTS	
	P11	P8	P4	P1
CEQ 1	daily	daily	daily	daily
CEQ 2	daily	daily	daily	daily
CEQ 3	very comfortable	very comfortable	somewhat comfortable	daily

3.2.2 Computer-Supported, Collaborative Work Survey

The results of the CSCW survey are shown in Table 3 (see pages A-2 – A-3 for details of each question[1]). All respondents responded identically to the survey items with the exception of CB2 and CD2. Participants did not complete CSCW surveys for the following mission sessions: Mission 1 Initial Brief, Mission 2 mid and final coordination briefs, and Mission 2 Striker/Transport brief.

Table 3: Computer-Supported, Collaborative Work survey

			AWACS		PILOTS	
Day	B/D	Question	P11	P8	P4	P1
Wednesday	Briefing	CB1	y	y	y	y
		CB1 Note				
		CB2	y	y	y	n
		CB2 Note				
		CB3	y	y	y	y
		CB3 Note				
		CB4	y	y	y	y
		CB4 Note				
		CB5	y	y	y	NA
		CB5 Note		Their title slide came up as was pointed out by package comd	PowerPoint pres. Was in our room and easy to follow	
		CB6	n	n	n	y
		CB6 Note	only after the brief in order to clarify finer points	possibly for technical coordinators	You want everyone listening to the briefer so they don't miss anything	
	Debriefing	CD1	y	y	y	n
		CD1 Note				lack of lessons learned due to lack of realism

[1] Note that some participants entered responses in the 'notes' section associated with questions. Sometimes these are meant to qualify a 'level' associated with their response, while other times it seems they were attempting to complete the questionnaire quickly and may have made a mistake.

			AWACS		PILOTS	
Day	B/D	Question	P11	P8	P4	P1
		CD2	y	y	y	n
		CD2 Note			4	
		CD3	y	y	y	y
		CD3 Note			y	some issues with playback
		CD4	y	y	y	y
		CD4 Note				
		CD5	y	y	y	y
		CD5 Note		same as previous day	through communication	
		CD6	n	n	n	n
		CD6 Note			same as brief comment	
		CB1	y	y	y	y
Thursday	Briefing	CB1 Note				
		CB2	y	y	y	n
		CB2 Note			3	
		CB3	y	y	y	y
		CB3 Note				
		CB4	y	y	y	y
		CB4 Note				
		CB5	y	y	y	y
		CB5 Note		same as previous day	PowerPoint and COMMS	
		CB6	n	n	n	y
		CB6 Note		same as previous day	Not during a mass brief or de-brief	not during brief but for sidebar during planning process
	Debriefing	CD1	y	y	y	y
		CD1 Note				
		CD2	y	y	y	n
		CD2 Note			3	
		CD3	y	y	y	y
		CD3 Note				
		CD4	y	y	y	y
		CD4 Note				
		CD5	y	y	y	y
		CD5 Note		Same as previous days	PowerPoint Pres. And Communications	
		CD6	n	y	n	n
		CD6 Note		Same as previous days	Not during a mass de-brief	

3.3 One-to-Many Communication Measures

3.3.1 Overall Session Time

Each mission consisted of at least one brief and one debrief session. The total duration for each session was recorded and reported in minutes. Overall, the majority of the briefing and debriefing sittings for missions 1 through 3 averaged 18.2 minutes (see Table 4). Two sessions that differed from the average were the Mass Brief from Mission 1 and the Strikers/Transport Debrief from Mission 2 with durations of 29.1 minutes and 8.6 minutes, respectively. The video analysis data suggest that the longer length of the Mass Brief in Mission 1 was a result of poor integration and time intensive configuration of the DCS mission log viewer into the CSCW system; the shorter length of the Strikers/Transport Debrief was a result of not involving all the participants directly.

Table 4: Overall Session Time

Mission	Session	Duration (minutes)
1	Initial Brief	20.5
	Mass Brief	20.8
	Mass Debrief	29.1
2	Mid Coordination Brief	14.1
	Final Coordination Brief	12.8
	Mass Brief	20.8
	Strikers/Transport Debrief	8.6
	Mass Debrief	19.8
3	Mass Brief	17.7
	Average across sessions	18.2

3.3.2 Mission Phase Time

Missions 1 to 3 had comparable average lengths within the Mass Brief (see Table 5). Transition time between phases for missions 1 to 3 had slight variability. The “role call” phase in mission 1 was much longer duration compared to the others. The reason the role call phase was longer in mission 1 was because role call was conducted on a per role basis. Subsequent role call phases consisted of “is everyone here?” questions resulting in both distributed teams answering “yes” together.

Table 5: Mass Brief – Mission 1, 2, and 3

	Mission 1		Mission 2		Mission 3	
Mission Phase	Length (sec)	Transition Time (sec)	Length (sec)	Transition Time (sec)	Length (sec)	Transition Time (sec)
Welcome - Introduction	13.1	0.0	9.2	0.0	6.06	0
Role Call	81.2	1.0	8.0	0.0	5.51	0
Weather	167.1	7.6	66.3	4.0	31.12	0
Training Rules	125.4	2.3	77.9	1.3	72.06	0.19
Intelligence brief	43.6	1.3	45.2	4.2	NA	NA
Package Commander	84.9	1.0	205.3	0.0	196	10.27
CGR	NA	NA	NA	NA	105	1
AWACS	45.2	3.2	65.0	4.5	37.3	0.91
OCA Commander	56.4	3.8	45.2	1.0	61.76	1.76
SEAD	43.0	2.5	44.3	27.7	51.27	5.21
DT	30.6	2.3	21.5	9.2	NA	NA
Transport	20.1	9.1	64.2	0.9	30	3.61

Mission Phase	Mission 1		Mission 2		Mission 3	
	Length (sec)	Transition Time (sec)	Length (sec)	Transition Time (sec)	Length (sec)	Transition Time (sec)
Hold Plan	24.3	5.6	11.0	0.0	27.36	1.79
Rehearsal	231.9	10.3	257.0	2.5	252.91	0
Contingency	32.8	0.7	212.0	13.2	134.27	0.18
MISMO - Summary	196.5		45.5		26.76	
Average Time	79.7	3.6	78.5	4.9	74.1	1.9

Mission 1 phase transition time was twice the length compared to the phase transition time of Mission 2 within the Mass Debrief (see Table 6). The difference in transition time between phases can be attributed to the "Route Playback – DCS" phase. The "Route Playback – DCS" in Mission 1 was higher than Mission 2 because of technical issues with the DCS software.

Table 6: Mass Debrief Mission 1 and 2

Mission Phase	Mission 1		Mission 2	
	Length (sec)	Transition Time (sec)	Length (sec)	Transition Time (sec)
Welcome - Introduction	12.1	0.7	14.4	0.0
Role Call	12.6	0.0	6.0	0.0
Debrief ROE	15.3	0.1	11.4	2.9
Package Commander	16.9	0.0	6.2	0.0
Game Plan Overview	28.9	0.0	12.3	0.0
Air to Air Commander	27.5	2.2	81.1	1.8
SEAD	52.8	0.0	21.2	0.0
AWACS	NA	NA	4.9	0.0
DT	NA	NA	47.8	0.0
Transport	27.7	1.8	41.0	9.5
AWACS	12.2	5.3	14.2	4.9
Route Playback - DCS	939.9	76.0	498.5	15.6
OCA	58.3	0.0	151.7	3.9
SEAD	42.0	0.0	47.3	3.7
SEAD	28.7	0.0	NA	NA
Transport	28.5	4.9	17.9	3.4
GCI/AWACS	147.3	4.1	14.4	3.1
Package Commander Summary	85.2	0.0	126.8	1.7
MISMO Summary	112.6		23.0	
Average Time	97.0	5.9	63.3	3.0

Phase data for Mission 1 Initial Brief, Mission 2 Mid and Final Coordination Briefs, and Mission 2 Strikers/Transport Debrief are reported in Table 7, Table 8, Table 9, and Table 10 respectively. These sessions varied in phase composition and order of presentation.

Table 7: Mission 1 – Initial Brief Phase Duration

Phase	Total (sec)	Time Between Phase (sec)
Description of Work	1067.5	0
Questions	161.6	
Average Time	614.6	0

Table 8: Mission 2 – Mid Coordination Brief

Phase	Total (sec)	Time Between Phase (sec)
Role Call	2.4	10.6
Review Overview	37.4	1.0
Planning ROE	7.1	2.4
Game Plan	45.1	1.7
Hold Plan	52.0	0.8
Game Plan Overview	170.9	0.6
Air to Air Game Plan	77.7	23.9
Transport	22.6	5.9
SEAD	86.5	2.2
DT	69.6	2.3
Tasking	204.8	0.0
Questions	20.8	
Average Time	66.4	4.7

Table 9: Mission 2 – Final Coordination Brief

Phase	Total (sec)	Time Between Phase (sec)
Start	2.7	0.0
Role Call	4.0	2.4
Changes to MidCord	22.0	0.0
Route Rehearsal	576.0	19.1
Whiteboard (excel spreadsheet)	66.2	10.8
Comms Card	9.3	0.0
Summary	29.1	1.3
Questions	26.4	
Average Time	92.0	4.8

Table 10: Mission 2 – Strikers and Transport Debrief

Phase	Total (sec)	Time Between Phase (sec)
Start	13.8	0.0
MISMO	2.9	4.2
Roll Call	8.7	0.5
Mission Objectives	20.4	0.0
Game Plan Overview	36.6	1.7
AWACS	17.4	0.6
Individual Flight Reviews	51.1	0.0
Strikers	68.2	2.8
Transport	17.8	0.0
Lessons Learned	72.1	0.0
OCA Execution	11.5	0.1
Slide preparation for Mass Brief	21.0	0.0
Prepare DCS for Mass Brief	163.7	
Average Time	38.7	0.8

3.3.3 Breakdown Time

The total numbers of breakdowns are presented in Table 11. Overall, there were few breakdowns noted. Of the breakdowns encountered, few were longer than one minute.

Table 11: Number of Breakdowns

Session	Mission			Total
	1	2	3	
FINAL CORD		1		1
INTB	1			1
MB	2	1	1	4
MD	3	2		5
MIDCORD		2		2
STMD		1		1
Total	6	7	1	14

The average breakdown length was approximately 90 seconds. A significant software breakdown occurred in Mission 1 during the Mass Debrief. After further investigation, Table 6 (phase data) reveals the software breakdown was directly related to the DCS mission log viewer by comparing the phase and breakdown durations (Table 12). The highest numbers of breakdowns were a result of user error. This was somewhat unexpected given the high comfort and experience level reported by participants in Table 2. No hardware errors occurred. The acronym LOE stands for "lack of operating experience". LOE identifies instances when the computer operator does not have the knowledge or experience to execute a software application command. LOE was resolved either by the on hand technical support person (P7) or by a team member. "U" identifies instances of user error. User error occurs when the computer operator mistakenly executed an incorrect command or pressed the wrong key/mouse click causing a delay in the presentation. User error extended to all participants to cover accidental errors (e.g., touching SMART board causes operator to loose control of presentation). "S" represents the failure of a software application (e.g., software

program crashes). It was expected that the software failure would cause the greatest interruption. "H" provided the classification for a hardware error (e.g., hard drive failure, monitor failure, etc.).

Table 12: Breakdown Lengths (sec)

Mission	Session	Breakdown Type	Start	End	Breakdown Length (sec)	Breakdown Length (min)
1	INTB	U	00:16:44:22	00:16:46:25	2.1	0.0
	MB	U	00:06:37:20	00:06:48:00	10.4	0.2
	MB	LOE	00:19:19:06	00:19:44:02	24.9	0.4
	MD	S	00:03:36:03	00:19:46:03	970.0	16.2
	MD	LOE	00:19:45:24	00:20:13:10	27.6	0.5
	MD	S	00:04:00:24	00:04:09:00	8.3	0.1
2	FINAL CORD	U	00:03:31:25	00:03:36:02	4.3	0.1
	MB	U	00:03:32:03	00:03:41:25	9.7	0.2
	MD	LOE	00:04:00:24	00:04:09:00:	8.3	0.1
	MD	S	00:13:20:02	00:14:24:11	64.3	1.1
	MIDCORD	LOE	00:02:31:12	00:02:34:00	2.6	0.0
	MIDCORD	U	00:07:49:06	00:07:53:12	4.2	0.1
	STMD	LOE	00:06:57:29	00:08:36:03	98.2	1.6
3	MB	U	00:09:49:10	00:10:10:19	21.3	0.4
				Average Breakdown Length	89.73	1.5

3.4 Many-to-Many Communication Measures

3.4.1 CSCW Tools

The tools available for use during the briefing and debriefing sessions were as follows:

- Computer operator station or other computer workstations (C)
- Polycom system (P)
- SMARTboard (SB)
- Whiteboard
- Printer (PR)
- Shredder
- telephones

The "C" was used to identify any computer use (operator or alternate workstation) in both SERF mission session locations. This included simple actions such as advancing the presentation slide. "P" refers to the Polycom video conference system and "SB" identifies each instance a participant used a SMART board pen to highlight or indicate (i.e., write words, lines, symbols, etc.) information displayed on the SMART board. "PR" was used to identify a printer. The frequency of tool use (i.e., number of times each tool used) is shown in Table 13.

Table 13: Frequency of Tool Use

Mission	Session	P	SB	C	PR	Total
1	INTB	6	0	57	0	63
	MB	8	3	90	0	101
	MD	8	1	57	0	66
M1 Total		22	4	204	0	230
2	MIDCORD	9	17	24	1	51
	FINALCORD	8	11	21	0	40
	MB	9	7	111	0	127
	STMD	9	1	19	0	29
	MD	9	0	64	0	73
M2 Total		44	36	239	1	320
3	MB	9	17	24	0	50
M3 Total		9	17	24	0	50
Total		75	57	467	1	600

The frequency of each tool was recorded by counting the number of times each participant used a specific tool during each mission session. The desktop computer was the most frequently used tool with a frequency of 467. The high frequency score of the desktop computer is a direct result of the Microsoft PowerPoint operator advancing each slide or facilitating playback commands for the DCS mission log viewer of Falcon View applications. Even though the Polycom video conference system was the primary mode of communication between the distributed teams, it only had a frequency score of 75. A count of "1" was tallied for each participant (passive or active) per mission session. The SMART board tool use increased from Mission 1 to Mission 2 and 3.

3.4.2 Turns

The number of turns per participant is reflected in Table 14 below. Mission 2 contained the largest number of turns compared to Mission 1 and Mission 3. The main reason for the difference in turn count is that more sessions were captured during Mission 2 than Mission 1 and 3 combined. Mission 3 had the lowest number of turns because only the Mass Brief was recorded. P1 had the greatest number of turns.

The minimum and maximum, and quartile spits for overall turn length are presented in Table 15.

Table 14: Number of Turns per Participant

Participant	Mission			Average	Total
	1	2	3		
P1	68	306	46	140.00	420
P10	1	10	4	5.00	15
P11	7	20	1	9.33	28
P2	39	118	13	56.67	170
P3	199	59	9	89.00	267
P4	4	3	1	2.67	8
P5	118	55	14	62.33	187
P6	71	86	6	54.33	163
P7	62	19		40.50	81
P8	4	31	2	12.33	37
PW	0	0	0	0	0
Average Turn Length	57.30	70.70	10.67		
Total	573	707	96		1376

Table 15: Turn Length Percentile

Percentile	Turn length (sec)
Minimum	0.03
25th percentile (i.e. short)	0.76
50th percentile (i.e. medium)	1.79
75th percentile (i.e. long)	5.56
Maximum	180.03

3.4.3 Active Participants

Active participants were defined as individuals that were present during the mission session and contributed verbally to the information presented to the distributed team members (see Table 16 for active participants per session). Technology operators (power point slide operators) were not considered an active participant unless they met the previously stated requirement.

Table 16: Total number of active participants per Mission

Part.	Mission 1			M1	Mission 2					M2	M3	M3	Total
	INTB	MB	MD	total	MCB	FCB	MB	STMD	MD	total	MB	total	
P1	1	1	1	3	1	1	1	1	1	5	1	1	9
P2	1	1	1	3	1	1	1	1	1	5	1	1	9
P3	1	1	1	3	1	1	1	1	1	5	1	1	9
P4	0	0	0	0	1	0	0	0	0	1	0	0	1
P5	1	1	1	3	1	1	1	0	1	4	1	1	8
P6	1	1	1	3	1	1	1	1	1	5	1	1	9
P8	0	0	1	1	1	1	1	1	1	5	1	1	7
P11	0	0	1	1	0	0	0	1	0	2	1	1	4
PW		0	0		0	0	0	0	0				
Total	5	5	7	17	7	6	6	6	7	32	7	7	56

3.4.4 Participant Transitions

The number of total transitions per participant are represented in Table 17. The slide transition count includes the presenter requests to the computer operator to advance the power point slide. Participants 1 and 2 have a significantly greater number of transitions compared to the other participants. An examination of the detailed phase data on individual sheets in the data file CSCW time data.xls and Table 17 indicates that those participants with a greater number of transitions directly relates to number of phases a participant was responsible for presenting and/or if the participant was the computer operator (i.e., advancing the power point presentation slides). Participants with a lower number transitions had fewer presentation responsibilities and were not used (or used rarely) as computer operators. P1 acted as the briefing and debriefing moderator for the majority of the missions, so it was not unexpected to discover that P1 had the highest number of questions compared to the other participants.

Table 17: Number of Transitions

Transition	Participant									Total
	P1	P2**	P3	P5	P6	P7	P8	P11*	PW*	
Introductions	33	5	14							52
Questions	96	27	32	20	30	13	3	3		224
Slide	156	235	40	50	7	5	1	1	7	502
Thank you	2		4							6
Total	**288**	**266**	**90**	**70**	**37**	**18**	**4**	**4**	**7**	**785**

*** indicates participant assuming role as computer operator**

3.4.5 Participant Turn Overlaps

For this observational study, an overlap refers to the instance when one participant speaks over another participant who is still talking.

Table 18 shows the number of overlaps committed by each participant by every other participant. The "?" indicates instances of overlap when the speaker could not be ascertained. PAll represents all the participants laughing in response to behaviour by the speaker.

P1 was overlapped by other participants the most, and interestingly, also committed the most overlaps against others. Which participants interrupt others and which participants are interrupted by others does not appear to covary with rank. Rather, an inspection of Table 14 reveals that those participants with greater number of speaking turns are also those participants who are most often interrupted by others and those who interrupt others. Similarly, those participants with the lowest number of speaking turns less often interrupted and did not interrupt others.

Table 18: Number of Overlaps

Participant Being Overlapped	Participant Overlapped By											
	P1	PAll	P11	*P2	*P3	P4	*P5	*P6	P7	P8	?	Total
P1		1		12	10		6	15	7	2	1	54
*P2	14		1		7		4	4	1			31
P8	2	1	1					2				6
P11	4			1		1				1		8
P4							1			1		2
*P3	10		1	2			7	11	2			33
*P5 n	3			8	6			11	8		1	37
*P6	11	1	1	5	4		10		2			34
P7	5			1	1		8		1	1		17
PAll	2			2	1		1					5
Total	51	3	4	31	29	1	37	43	21	5	2	227
		* indicates participant is a retired member of the CF										

4 Discussion

The participants worked to mutually benefit one another, by operating in a cooperative manner by sharing and dividing tasks. During the briefing and debriefing phases, individuals were working towards the same goal, but it is unclear if this is considered true collaboration. The briefing and debriefing sessions had a fairly consistent and rigid structure, and were a forum to present and review information in a structured process. Some extra footage that was captured during the video recording process involved a small part of a planning session. This video data was not coded, but was superficially assessed to note any difference between the structured session and an unstructured one. The planning session appeared to demonstrate a higher level of collaboration than the brief and debrief sessions. Participants were verbally transferring information to each other using the video conference system that demonstrated a higher mutual dependency than what was demonstrated in the brief and debrief sessions. The CSCW system provided necessary tools for the individuals in different locations with different responsibilities to interact and conduct work.

The orientation of the SMART board was used in coordination and floor control. All participants in the downstairs SERF room focused their attention to the SMART board when information was being presented or discussed. Participants in the upstairs SERF room had the SMART board information being displayed on a computer screen which did not command that same amount of attention as the SMART board. Upstairs participants' attention sometimes was directed away from the presentation and in some cases, presenters had to be prompted multiple times to address their phase during the brief or debrief. The SMART board is an important CSCW tool because it has the potential to serve multiple functions other than focusing attention. The SMART board can be used to store information, express ideas, and mediate the interaction between geographically separated team members.

However, the SMART board fails to convey specific and precise information of hand gestures. Even in conjunction with the Polycom system, hand gestures were not communicated to participants outside of the location they were made. It is difficult to ascertain why, but very few gestures were made at all during the 3 missions. All the participants relied on the use of verbal cues and the SMART pen when discussing specific information displayed on the SMART board. Upstairs participants could have seen gestures made by downstairs participants (not the presenter) via the Polycom video conference system. However, downstairs participants would have had difficulty observing any gestures made by participants upstairs because the Polycom camera was situated to close to the upstairs participants. In most instances, upstairs participants had to crowd around the Polycom system resulting in a close-up shot of their torso displayed in the field of view.

Given the nature of the federated CSCW system, the participants were fortunate not to experience any major hardware or software breakdown. Two factors that reduced the negative impact and number of breakdowns could be attributed to learning effects and the ability of the technical support person to move freely between the downstairs and upstairs SERF locations.

The ability of the technical support person to move freely between the two locations contributed to the quick resolution of any hardware or software breakdown. Had the two meeting locations been geographically separated by a large distance, breakdowns would presumably have taken longer to resolve. Also, if the breakdowns were not resolved, they would certainly have affected the participant's ability to complete their work responsibilities.

Another factor in the small amount of breakdowns can be attributed to learning effects. The more frequently participants performed tasks using the CSCW system the more efficient they became at resolving user and lack of operating experience errors. Participants became more willing and better equipped to assist one another in using the CSCW tools that they were previously unfamiliar with.

An example of this behaviour clearly illustrates this point. An upstairs SERF room participant was having difficulty understanding what information was being emphasised on a map display. The participant presenting the data (downstairs SERF room) was directing the computer operator to use the mouse cursor to highlight specific flight path information on the SMART board. The upstairs participant requested the presenter to use the SMART pen on the interactive whiteboard to make the highlighting more obvious. The presenter did not know how to use the SMART pen effectively and was coached by other briefing participants to use the tool correctly. The SMART pens were used in a more effective manner after this experience.

The breakdowns that did occur should be considered minor and not surprising given the different hardware and software components being integrated together. From the data collected, it was difficult to assess what impact the breakdowns (that did occur) had on group efficiency and motivation. Participants appeared willing to work through the user error and lack of operating experience breakdowns, but exhibited some signs of impatience when the DCS mission log viewer did not function as expected. A work around solution resolved the software error (run DCS through internal SERF networked computers), but we suspect if the system resulted in a major hardware breakdown, group efficiency and motivation would have significantly decreased.

5 Conclusions and Recommendations

To accurately assess user requirements for the DRDC Toronto's CSCW system(s), the following areas should be specifically addressed: simulated scenarios designed specifically to address CSCW tool use; group dynamics; task-oriented communication; better integration of federated tools; and geographically separated teams.

It may be beneficial to construct and test a specific hypothesis related to how CSCW tools affect different areas of communication, preparation, and information sharing within a military context. Simulated scenarios could be created to identify specific work tasks and define what users are expected to do. The scenarios or work environments could be configured so each environment is supported by different collaboration tools (e.g., use of interactive whiteboard, use of Polycom system, audio, no audio, text messaging, etc.). Setup the scenarios so the level of mutually dependent work varies from task to task.

Group dynamics need to be assessed more thoroughly in determining user requirements. The interaction between strangers versus people that know each other well may be significantly different. Within Maple Skies, all the participants had some level of familiarity with each other prior to the study. The result of CSCW evaluation may have differed if another team was used that was not familiar with one another. Participants in CSCW observational study seemed comfortable and casual around one another leading to a very relaxed and comfortable environment. It would be worthwhile to evaluate a group of strangers to determine if performance measures are comparable. Specific user requirements for the CSCW system will need to consider the familiarity level of teams.

Evaluating the mission briefing and debriefing stages will be useful for identifying CSCW user requirements that focus on task-oriented communication between team members. Another important aspect of team collaboration occurs during the various planning stages. From the phase data collected, the briefing and debriefing stages are very structured. It may be beneficial to determine CSCW user requirements for a less ordered environment or tasks that require geographically separated team members to work more together on a task. That is, team members have to work collectively and simultaneously to complete the task. From the video data, participants in Maple Skies completed their work outside of the briefings. It also could be beneficial if there was a method for a member from each geographically distributed team to have ability to engage in a side bar conversation, especially if the content of the exchange is not relevant to the group's work.

The DCS mission log viewer needs better integration into the CSCW system. The majority of the breakdown time comprised technical assistance. The DCS was shared through the SERF network which may not have been available if the two groups had not been collocated. In most cases with the DCS, it was not because of the user's lack of operating experience that contributed to the problem, but rather the DCS had difficultly integrating with other CMTR software applications (e.g., Bridge-It). The advantage of the federated system allowed the use of the mission log viewer, but it significantly affected timely delivery of the information. Also, use of the DCS required the skills of a specialized operator. If no technical support was present at the time of operation, the mission team members would not have received the detail required to conduct an effective debrief.

The geographic distance between the study participants was not sufficient. Two rooms within the SERF were used – a downstairs conference room and an upstairs office. The physical distance separating the rooms was easily overcome by the study participants, who frequently travelled between them during differently stages of the mission. To effectively study and define user

requirements for the associated briefing and debriefing activities, the CSCW system should also be evaluated using two geographically separated locations. Participants in this study experienced a level of interaction and collaboration that would not be possible if the individuals were prevented from direct contact with one another.

Annex A Questionnaires

Computer Experience Questionnaire

Please answer the following questions by placing an X in the location on the line that corresponds to your computer experience.

1. What is your frequency of computer usage?

Never Daily

2. What is your frequency of Office suite software usage? (e.g. Word, PowerPoint, Excel)

Never Daily

3. How comfortable are you with Office suite software? (e.g. Word, PowerPoint, Excel)

Uncomfortable
(I don't know how to do anything)

Very Comfortable
(I know shortcuts for many things)

Computer-Supported, Collaborative Work Survey

Name: _____

Day: Wednesday ☐ Thursday ☐ Friday ☐

Brief or Debrief: Briefing ☐ Debriefing ☐

Based on the (de)briefing that you just attended, please mark your responses to the questions below.

CB1: Was the main goal of the briefing accomplished?

YES **NO**

If **NO**, what was the major factor prohibiting the completion of the goal?

_____

CB2: Could you identify all of the aircrew, at local and remote sites, involved in the briefing?

YES **NO**

If **YES**, how many people were at the remote location(s)?

_____

CB3: Could you see/follow the material (documents, presentations, etc) that were being referenced by the presenter?

YES **NO**

If **NO**, what was the major difficulty in following the presenter and reference material?

_____

CB4: Could you tell if remote people could be interrupted?

YES **NO**

If **NO**, what was the major difficulty in obtaining this information?

_____

CB5: Could you tell when other people were ready to continue to the next topic of the briefing (e.g., after detailed flight plans were uploaded)?

YES **NO**

If **YES**, how did you obtain this information?

_____

CB6: Would private communication with a participant from the other remote locations(s) be of benefit?

YES **NO**

If **NO**, could you envision a scenario would be of benefit during a distributed briefing?

_____

Generic Measures of Performance – Mass Brief and Mass Debrief

For each measure listed below, please circle the category (i.e. Poor, Marginal, Standard, Very Good, and Exceptional) that maps to the actions you just observed. Use the behavioural descriptions, and "Look For's" to direct your choice. If you feel the measure is Not Applicable, then write N/A in a blank space somewhere on the measure. Please place a response for every measure.

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional
A1. Tactics: Task and ROE understanding, route review/analysis				
Accepted mission tasking without review of important information	Accepted mission tasking with some review of key information	Good review of important information and understood the mission tasking	Carefully analyzed the mission tasking and important information	Completely analyzed the mission tasking and all related information Logical deductions and inferences were made based on available information
Look for: Thorough review of Air Tasking Order (ATO), Airspace Coordination Order (ACO), Intelligence update Understood where mission fits in overall big-picture plan Thorough review of target area and routing Thorough review of ROE, FLIP, NOTAMS Threat analysis/update Aware of significant terrain or hazards to flight along planned routing Ingress/egress corridors, location of friendly forces. Ensured all remote-site participants included where appropriate?				

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional
A2. Tactics: Factors considered in plan, development of mission tools.				
No consideration of key planning factors No additional tools added to mission execution plan	Some discussion of planning factors Minimal tools added to mission execution plan	Identified and analyzed many key planning factors Incorporated some tools into mission execution plan	Identified and analyzed all key planning factors Integrated many additional tools into the mission execution plan Challenged/ questioned plan assumptions	Provided a detailed analysis of all key planning factors All tools were incorporated into the mission execution plan
Look for: Were key planning factors or inputs omitted, if so for what reason? Was there due consideration of all factors in tactical plan selection? Was the plan selection discussed with other crewmembers/ wingmen and were valuable inputs considered? Tactics considered for each mission phase? Did the tactics planned conform to the big-picture plan. Were all potential threats analysed and proper tactics incorporated. Were environmental conditions planned for. Ie cloud cover, in-flight visibility, terrain masking Ingress/egress corridor selection Wingmen planning responsibilities defined Ensure all non-site participants included where appropriate?				

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional
A3. Tactics: COA and contingency plan considers performance factors, malfunctions, weather, alternate airfields				
Accepted mission plan with no consideration of "what-if" contingencies	Some discussion of "what-ifs" No attempt made to incorporate contingency options into mission plan	Identified some "what-if" contingencies Incorporated these into mission plan	Identified many "what-if" contingencies Incorporated most into mission plan	Provided detailed consideration of "what-if" contingencies Integrated these into mission plan
Look for: Planned for what if's in the primary mission plan Planned for secondary / alternate missions and applicable what if's Planned for battle damage, missing wingmen, late arrivals Planned departures / arrival contingencies (ex. Delayed take-off,,holds etc) Weather contingencies / abort plan/ alternate airfields Alternate tactics considered for each mission phase? What if's related to intelligence brief				

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional
A4. Tactics: Use of planning tools: reference to planning items in mission planning kit				
Little or no reference to available planning tools in constructing mission plan	Periodic reference to some tools in constructing mission plan	Frequent reference to some of the tools in constructing mission plan	Extensive reference to most of the available tools in constructing the mission plan	Extensive reference to all available tools in constructing the mission plan
Look for: Use of SOPs Use of pre-planned material / tools Use and adherence to current tactics manual / Airplane Operating Manual Use of applicable computer programs for mission planning NOTAMs, hazards, and in-flight weather updated Check primary airfields and alternate for suitability Check maps, target area photos, satellite imagery and FLIR pics for accuracy Request specific resources required for planning, ie satellite imagery, reconnaissance photos etc. Was the material visible/accessible to both local and remote sites? Did the presenter make effective use of the tools? Were there appropriate communications with remote mission participants prior to briefing?				

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional
A5. Time management: time appreciation, efficiency in time spent planning to accomplish all required planning activities				
No time appreciation carried out Spent minimal time planning Much of the time was unproductive	Cursory time appreciation carried out Spent more than the minimal time planning but not much Considerable unproductive time	Time appreciation was carried out Spent adequate time planning Does not use all available time	Good time appreciation considering most inputs Spent considerable time planning Made effort not to have unproductive time during the planning session	Ideal time appreciation made (including due consideration for non-standard timings and inputs) Used all available time planning Little or no unproductive time during the planning session
Look for: Adequate time appreciation made with due consideration for non-standard inputs Time appreciation and plan communicated to other formation members Time appreciation monitored and revised during planning process				

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional
A6. Function allocation and Team Performance				
Flight lead provided no direction for planning responsibilities Wingman engaged in planning with no discussion of roles	Flight Lead gave limited direction for planning responsibilities and expectations	Flight lead gave good direction to all flight members concerning planning responsibilities	Flight lead provided clear direction to all flight members concerning planning responsibilities and guidance on time to be spent in planning Flight lead outlined expectations for planning products Flight lead reviewed crew products	Flight lead provided very clear direction to all flight members for planning responsibilities and guidance on time to be spent in planning Flight lead monitored planning process of wingmen and provided timely and appropriate feedback Flight lead reviewed all wingmen products and all errors were rectified
Look for: Responsibilities were delegated by the mission lead iaw SOPs Responsibilities were delegated according to individual strengths Expectations of Flight lead were clear and completion timings given. Wingment planning activities were appropriately supervised Planning products were well reviewed, errors were found, explained and corrected Flight lead able to supervise wingmen without sacrificing own responsibilities				

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional
A7. Quality of planning products: Fuel plan: level of detail, quality of plan, use of computer products				
Accepted fuel plan as given with no further observation	Checked fuel plan Made no additional adjustments	Checked fuel plan Considered making some adjustments based on additional planning factors (required alternate, weather changes etc)	Considered fuel plan against a range of options (e.g., engine loss, unexpended ordnance, low-level ops etc.)	Included all mission critical and environmental variables in fuel plan
Look for: Considered primary plan and contingencies (what if no air-to-air refuelling, weather enroute, engine failure enroute). Ensured fuel available is enough to conduct mission safely.				

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional
A8. Quality of planning products: TOLD: consideration of airfield info, obstacles, performance factors, NOTAMs, fuel load				
Computed TOLD with major errors and omissions	Computed TOLD with several errors and/or omissions	Computed TOLD with minimum errors Minimum mission requirements addressed	Computed TOLD with no errors Most mission variables addressed	Computed TOLD with no errors All mission variables addressed
Look for: Computed TOLD parameters for departure and arrival airfields (including alternates). Included other flight members in TOLD factor calculation Is TOLD for future events based on future meteorological data, or planned using current data? Updates in weight, weather, runway surface conditions, barometric pressure and temperature considered? Is TOLD calculated for contingencies (backup aircraft configurations, fuel loads, weapons loads)				

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional
A9. Quality of planning products: Comm plan: level of detail, quality of plan, use of computer products				
Accepted comm plan as given with no further consideration	Checked comm plan Made no additional adjustments	Checked comm plan Considered making some adjustments based on additional planning factors (IFR/VFR, INTER-FLIGHT	Considered comm plan against a wide range of options (e.g., AWACS, GCI, Comm-jamming etc.	Included all mission critical and environmental variables in comm plan
Look for: Understands complex C2 structure Indicated mission critical comms Considerations for alternate comm plan, secure requirements, monitoring of common / important frequencies, comm jamming, comm failure				

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional
A10. COMMUNICATION: Mission briefings: detail, comprehensiveness, overall effectiveness				
Little or no mission briefing. Time wasted on irrelevant communication Overall plan not explained	Minimal mission briefing. Most elements covered. Provided little detail on objectives Overall plan not well explained	Brief contained some inconsistent mission details Overall plan explained with some detail	Detailed briefing Many elements covered with acceptable level of detail Overall plan well explained and understood	Highly detailed mission brief. All mission elements covered with great detail Overall plan very well explained, communicated and understood by all flight members
Look for: Were the mission objectives clearly stated and accurate. Was key info omitted? Were there parts of the brief requiring more detail? Were references to SOPs used to avoid “over-briefing” Was the time available well used to cover most critical items of the mission and were they well prioritized? Was it rushed? Was it well structured or fragmented and un-organized? Was the actual tactical plan well explained? Do flight members appear to leave briefing with understanding of mission? - with confidence? Were there appropriate communications with remote mission participants? Proportion of time spent on domestics* and time spent on actual tactical plan ***** domestics – includes from take-off to tactical area and tactical area back to landing				

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional
A11. Technology mediated communication: consider the effectiveness of devices such as Smartboards and video-conferencing, during distributed meetings.				
Time was spent addressing technical problems negatively affected understanding mission plan or lessons learned. Remote participants did not receive the same information as local participants. Interaction with devices distracted from the goal of the meeting.	Some time was spent addressing technical difficulties. Had to wait for remote participants to receive information. Poor transitions between briefings due to technical difficulties.	Some time was spent addressing technical difficulties. Local and remote participants received the same information. Incorporates some devices into mission execution plan.	The use of the devices did not distract from the meeting. Similar experience as an "in person" meeting. Integrates many additional devices into the mission execution plan.	Remote participants had same level of input/interaction as local participants. Devices were seamless used in the presentation. Devices used in the meeting was optimal for the presentation of the mission execution plan
Look for: Could you identify all air crew participating at the remote sites? Could you tell if remote people could be interrupted? Could you tell when remote participants were ready to continue to the next topic of the briefing? Was there a need for private communication with participants at a remote site? Was the transition between briefings seamlessly accomplished?				

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional
A0. Overall Planning and Briefing Behaviour				
Planning behaviours were significantly below expectations.	This level of proficiency is less than desired for effective coordination during the mission. There is room for much improvement.	Behaviour promoted and maintained coordination and mission operations effectiveness. This is the minimum standard level of proficiency that should be expected during this mission.	Planning behaviours were significantly above expectations.	Behaviours represent a high level of skill in the application of specific behaviours, and serves as a model for coordination, teamwork and highly efficient mission operations.

Mission Execution

Generic Measures of Performance

For each measure listed below, please circle the category (i.e. Poor, Marginal, Standard, Very Good, and Exceptional) that maps to the actions you just observed. Use the behavioural descriptions, and "Look For's" to direct your choice. If you feel the measure is Not Applicable, then write N/A in a blank space somewhere on the measure. Please place a response for every measure.

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional
B1. Plan compliance: Navigation accuracy: awareness of current location, adherence to plan considered				
Pilot was lost/disoriented No adherence to planning routing Unable to meet objective requirements	Often deviated from / is unsure of routing Was only able to meet objective requirements with difficulty	Generally able to follow the planned routing Several off-track deviations performed to meet objectives	Was able to adhere to planned mission routing Was aware of position with respect to objectives at all times	Was continually aware of position and anticipating routing ahead Able to make timely and appropriate adjustments to meet objective requirements
Look for: Accurate position with reference to planed route. To include mission target Accurate position (with reference to overall mission eg. Other aircraft) Appropriate routing corrections adjustments made (necessary for mission completion) Flight members adapt to the current situation Crew anticipation of routing ahead Perform adequate checks on nav data entered into flight computer Any questioning of flight-members with regard to navigational position				

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional
B2. Plan compliance: Time control: planned timings were met				
Missed many important time milestones Was continually "behind the mission" throughout	Missed several key time milestones	Hit all major time milestones Missed several minor ones	Hit all time milestones	Hit all time milestones and was continually "ahead of the mission" throughout
Look for: Mission starts on time; on-station on time; push on time Hit ETAs (eg., tanker times, time-on-target,) within appropriate time deviation. Ability to analyse and correct timing deviations				

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional
B3. Communications systems usage: stay on correct frequency, talk to proper agency, correct terminology				
Frequent problems in contacting proper agency or using correct frequency	Periodic problems in contacting proper agency or using correct frequency	No major problems in contacting proper agency or using correct frequency	Proper agencies contacted, correct frequencies, code words and call signs were used throughout	Clear, efficient communications executed throughout entire mission
Look for: Correct frequency, correct agency used/contacted throughout Get all clearances when needed Use of appropriate call signs? Use of appropriate code words? Correct terminology? Clear concise phrasing? Transmit only when situ required? Number and frequency of comms appropriate to situation? Responds appropriately and promptly when contacted by external agency/formation member(s) Flight members question communication when not in agreement with what is being observed Properly monitors all appropriate frequencies No broadcast or specific information missed Followed proper com-jamming procedures (refers to section 4c in planning)				

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional
B4. Aircraft handling and control: airspeed, altitude, heading				
Excessive flight path deviations which were not corrected in a timely manner	Some flight path deviations which were not corrected in a timely manner	Few flight path minor deviations which were corrected in a timely manner	Minimal flight path deviations which were corrected in a timely manner	Minimal flight path deviations which were anticipated and corrected in a timely manner
Look for: Maintains adequate terrain clearance. Maintains safe separation from other aircraft. Maintains correct flight parameters (ground speed, altitude, heading) throughout the mission. Speed/accuracy of corrections to observed errors in aircraft flight parameters. Speed/accuracy of changing flight parameters when requested by external agencies (ATC, AWACS, Flight Lead). Anticipation of required changes Optimum aircraft performance attained and maintained Degree to which over-corrections to observed errors were made				

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional
B5. System awareness: Checklist accomplishment: checklists accomplished in a timely, accurate manner				
Fails to complete many Emergency and/or normal procedures/ checklists	Most Emergency and/or normal procedures/ checklists complete Not timely or missed items	All required Emergency and/or normal procedures/ checklists complete	All required Emergency and/or normal procedures/ checklists were completed in timely manner Covers all items	All Emergency and/or normal procedures/ checklists completed in timely manner or early Efficiently covers all items
Look for: Ability to perform normal procedures items by memory without mistakes Completed before start checklist, before taxi checklist, taxi checklist, before takeoff checklist, arming point checklist, line up checklist on time Completed all tactical checklists properly and at the appropriate time (fence-in check, Go/No Go checklist, air-to-ground checklist, fence-out checklist) Complete descent checklist, before landing checklist, after landing checklist, and de-arming checklist on time Completed all necessary emergency checklists (if required) in a timely, safe, and efficient manner Completed all emergency memory / recall items timely and accurately				

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional
B6. System awareness: sensors, status indicators				
Failed to recognise critical changes in sensors or status indicators	Slow to recognise critical changes in sensors or status indicators	Recognised and responded to critical changes in status or sensors	Integrated and correlated information between sensors	Used available information quickly and efficiently according to an expert strategy
Look for: Awareness of overall aircraft status and indications including all operational, degraded, and unserviceable items (fuel, flight controls, avionics, aircraft subsystems, weapons) Awareness of sensor status and information (radar, FLIR, RWR, data link, jammers, IFF interrogator, etc). Awareness of what impact specific changes to aircraft or sensor status will have on overall mission. Amount of time required to notice changes to aircraft system/sensor status. Ability to correlate information between different sensors / indicators				

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional
B7. Resource and flight member awareness				
Fails to detect changes in wingmen status or mission resources	Missed some changes in wingmen status or mission resources	Detects critical changes in wingmen status or mission resources	Rapidly detects critical changes in wingmen status or mission resources Responds to wingmen communications regarding status Planned/ compensated for changes in crew status or mission resources	Proactively scans for info regarding changes in crew status or mission resources Clearly sets/reminds wingmen roles
Look for: Ability to detect formation members divergence from mission plan Formation integrity monitored and maintained Awareness of position and actions of other formation members throughout the mission Awareness of status of critical mission resources and actions taken when mission resources change Communications re flight member status missed (For Mission Commander/OC) maintaining awareness of other formations in the overall plan Accurate and timely directions given to flight members / mission resources with changes in tactical situation				

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional
B8. Tactical awareness: contact detection, spatial awareness, co-ordination, monitors formation, applies other COA				
Fails to detect contact in timely manner Lost sight of friendly/enemy entities Engagement quality dropped during comms Could not asses and fly at same time	Frequently out of position Employs incorrect tactics Did not co-ordinate with formation	Detected at appropriate range Recognised enemy tactics Adopted correct tactics	Detected enemy at earliest opportunity Monitored formation Adopted appropriate tactics to changing tactical situation	Flied optimum engagement profile Co-ordinated effectively with formation Anticipated enemy
Look for: Ability to detect contacts with sensors Awareness of position relative the mission routing, enemy formations, friendly assets Ability to understand local tactical environment and choose effective COAs Ability to monitor and direct other formation members COAs Awareness of enemy formations actions, and anticipation of outcome Maintaining pre-briefed roles or dictating any change of roles as required				

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional
B9. Mission and goal awareness: re-establishes mission goals, detects and responds to changes in mission picture				
Failed to detect changes in mission situation following engagement Poor resumption of nav plan/join of formation following engagement	Recognised change in mission picture Unsure of appropriate COA in response to change Unsure of mission goals at various points in mission	Recognised changes in mission situation and adjusts appropriately Followed pre-briefed contingency plan.	Integrated information to quickly recognise changes in mission picture Rapidly updated plan and communicated changed picture and plan	Anticipated changes in mission picture Had contingency mission goals
Look for: Maintaining a broad scan of info sources and reacted accordingly. Ability to comprehend current changes in the tactical environment and apply pre-briefed contingency plan. If no pre-briefed contingency plan, able to formulate and communicate a COA to ensure mission success. Ability to anticipate the effect of current changes in the tactical environment on future events in the mission. Appropriate assessment of tactical situation and use of defensive, offensive and neutral manoeuvring tactics				

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional
B10. Engagement skills: aircraft handling, energy management, gained/maintained offensive advantage				
Constant and large deviations from ideal energy state Quickly lost clearly offensive position Was ineffective to counter bandits offensive	Many deviations from ideal energy state Maintained position but was unable to fly to a weapon engagement zone or to leave the engagement	Good energy management and A/C manoeuvering Maintained offensive position and employed weapons Countered bandits offensive manouvers	Very sound energy management and aircraft manoeuvering Quickly capitalized on offensive position Effectively countered bandits offensive to a neutral position	Ideal Aircraft energy management and manoeuvering Expeditiously capitalized on offensive position Quickly reversed from a defensive to an offensive position
Look for: Maintained visual with formation and maintained tally on bandit or bandits. Aircraft airspeed, g, and angle of attack Reactions to bandits manoeuvering and energy state Appropriate game plan used Recognition of turning room Lift vector placement Divergence for ideal energy state Awareness of altitude Quick exit after engagement or when opportunity presented				

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional
B11. Weapon Employment Air-toAir: recognition of weapons employment opportunities, satisfied ROE, validity of shots at trigger squeeze				
Did not recognize entry into WEZs Failed to employ weapons according to the briefed plan Most shots did not meet all shoot criteria at trigger / release	Did not recognize some weapons employment opportunities Generally did not follow weapon employment plan Some shots did not meet weapons release criteria	Recognized entry into most WEZs Generally employed weapons according to briefed criteria Met all weapon shoot criteria at trigger / release	Recognized all WEZs Employed weapons according to briefed criteria Met all weapon shoot criteria at trigger / release Appropriately assessed requirement for follow on shots	Anticipated and recognized all WEZs opportunities Always employed optimum weapon according to briefed first / ideal opportunity All criteria met for all weapon releases Always anticipated and recognized requirement for follow-on shots Recognized all degraded / Lower PK situations
Look for: WEZ (Weapon Engagement Zone) WEZ entries and anticipation Missed weapons opportunities Proper weapon selected and employed Weapon Pk at trigger / release (% of RNE, Range No Escape) All release criteria met at trigger Recognition of follow-on shot requirement Validated kills based on kill-criteria				

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional
B12. Weapon Employment Air-to-Ground identified proper target, valid delivery parameters, released weapons on target				
Did not identify proper target Failed to meet delivery parameters for successful weapon delivery Released weapons off target(ie, wrong pickle point)	Identified target but not in position for desired weapon release parameters. Weapon release marginally on target.	Identified target Generally met delivery parameters Weapon release on target	Identified target with time to spare Most delivery parameters met Weapon release right on target.	Identified target with time to spare All delivery parameters met Weapon release right on target
Look for: Late target identification Pressing a bad attack Awareness of other flight members Respect for fragmentation envelops Proper switchology Target channelization				

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional
B13. Threat Reactions: recognition of exposure to threats, effectiveness of threat reactions, knowledge of threat performance/capabilities				
Failed to avoid or recognize most threats Did not perform appropriate counter manoeuvers to threats Did not react appropriately when enemy employed weapons	Recognized most threats When threat recognized, did not always perform appropriate counter manoeuvers Did not react to all enemy weapons opportunities	Avoided some threats Recognized all threats Performed appropriate counter manoeuvers Reacted to enemy weapons opportunities	Avoided most threats Quickly recognized all threats Effectively performed appropriate counter manoeuvers Denied enemy of most weapons opportunities or quickly reacted accordingly	Avoided all non-necessary threats Anticipated all potential threats and proactively performed ideal counter manoeuvers Denied enemy of weapons opportunities
Look for: Anticipation and recognition of threats Pre emptive counter manoeuvrers (terrain-mask, chaff-weave , pre-emptive flares) Appropriate counter manoeuvers performed when approaching threats (beam,drag, terrain-mask) Effectiveness of Counter manoeuvers Deny enemy weapons opportunities Ability to assess follow on threats when reacting Employment of appropriate counter measures (Chaff, Flares, Jammers, IRCCM) Maintain formation integrity post threat reaction.				

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional
B14. Role discipline: ability to fulfill assigned role within the mission, ability to follow the briefed plan, ability to support other crew/formation members during mission				
Unable to perform or was ineffective at most individual responsibilities Unable to support others or negative contribution Mostly contributed negatively by assuming wrong responsibilities Produced chaos in the formation	Missed some critical individual responsibilities Partially supported others when required Sometimes contributed negatively by assuming unnecessary responsibilities	Performed all individual responsibilities Supported others most of the time Was able to assume other role responsibilities some of the time	Performed all individual responsibilities with high standard Timely supported others when required Effectively assumed other role responsibilities when required	Ideally and timely performed all individual responsibilities Anticipated degrading situations or opportunities and immediately supported others when required Instantly and ideally assumed other role responsibilities when required
Look for: Performance of individual responsibilities Assertiveness in role Respecting other roles responsibilities Timely response and support Ability to perform other roles, additional duties Overall contribution to mission success				

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional
B15. Achievement of primary mission objectives				
Primary mission objective(s) not accomplished Did not survive the mission	Some mission objective(s) not accomplished Survivability jeopardized on several occasions	Mission objective(s) satisfactorily accomplished Minimal threats to survivability	Mission objectives easily accomplished Did not place survivability of formation at risk	All mission objectives accomplished in an optimum, safe, efficient manner Ensured survivability of own and other mission assets
Look for: Clear understanding of mission objectives Awareness of what were the critical tasks to perform in order to accomplish mission objectives Awareness of how mission events might affect accomplishment of mission objectives Unnecessary exposure to enemy threats, terrain, and close proximity of other aircraft that jeopardizes the survivability of the formation Ability to perform self analysis of progress vs. objectives and adjust COA's accordingly				

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional
B0. Overall Mission Execution Behaviour				
Mission execution behaviours were significantly below expectations.	This level of proficiency is less than desired for effective coordination during the mission. There is room for much improvement.	The demonstrated behaviour promotes and maintains coordination and mission operations effectiveness. This is the minimum standard level of proficiency that should be expected during this mission.	Behaviours were significantly above expectations.	Behaviours represent a high level of skill in the application of specific behaviours, and serves as a model for coordination, teamwork and highly efficient mission operations.

Mission Debriefing

Generic Measures of Performance

For each measure listed below, please circle the category (i.e. Poor, Marginal, Standard, Very Good, and Exceptional) that maps to the actions you just observed. Use the behavioural descriptions, and "Look For's" to direct your choice. If you feel the measure is Not Applicable, then write N/A in a blank space somewhere on the measure. Please place a response for every measure.

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional
C1. Overall quality and communication				
No debrief provided or only cursory mission debriefing	Debrief provided Critical issues left unresolved	All debrief elements covered with acceptable level of detail for mission objectives	Detailed debrief with all mission elements covered	Highly detailed debrief covering all mission elements
Look for: Was the debrief length appropriate to the complexity of the mission and the potential lessons learned Topics covered were relevant to goals No excessive time spent on any unimportant topics Audio-video/playback tools: did crew take advantage of capabilities to review their own technical/CRM performance? Were audio/video tools cued to appropriate occurrences to aid in de-brief continuity. Does the debrief follow a logical review of mission events? Was the reconstruction of the mission events accurate? Did the mission lead involve crew when required? (Interaction of the crew during reconstruction and debrief)				

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional
C2. Flight members Team Performance: focus on team performance/leadership				
Failed to accomplish a debrief of each fight members' team performance Did not identify any critical performance deficiencies	Accomplished a minimal debrief of each fight members' team performance Identified few critical performance deficiencies	Accomplished a debrief of each fight members' team performance Identified only critical performance deficiencies	Accomplished a debrief of each fight members' team performance Identified critical & some non-critical performance deficiencies	Accomplished a thorough and accurate debrief of each fight members' team performance Identified all critical & non-critical performance deficiencies
Look for: Identified and expanded on areas of the mission where team performance/leadership was strong/weak. Recognized lessons learned and proposed and discussed different methods to improve CRM. Were critical teamwork incidents covered? Is 'no blame' culture maintained? Leadership, followership and adherence to roles and responsibilities				

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional
C3. Mission outcomes: focus on accomplishment of mission objectives				
Failed to accomplish a debrief of mission Did not identify any critical mission deficiencies	Accomplished a minimal debrief of mission objectives Identified few mission critical deficiencies	Accomplished an acceptable debrief of mission objectives Identified only critical mission deficiencies	Accomplished a debrief of mission objectives Identified some mission deficiencies and some non-critical issues	Accomplished a thorough and accurate debrief of mission objectives Identified all critical and some non-critical deficiencies
Look for: Does debrief centre on determining whether mission objectives were achieved? Is a quantitative assessment conducted to assess overall mission objective success? Are valid reasons for failure to achieve specific mission objectives provided? Are the lessons learned recognized Focus on improving performance Consideration of alternative approaches to mission Do flight members leave debrief with positive attitude? Lessons learned if mission was not successful.				

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional
C4. Flight members technical performance: focus on technical performance				
Failed to accomplish a debrief of flight members' technical performance Does not identify any critical performance deficiencies	Accomplished a minimal debrief of flight members' technical performance Identified few critical performance deficiencies	Accomplished a debrief of each flight members' technical performance Identified only critical performance deficiencies	Accomplished a debrief of each flight members' technical performance Identified critical and some non-critical performance deficiencies	Accomplished a thorough and accurate debrief of each flight members' technical performance Identified all critical and non-critical performance deficiencies
Look for: Was there a distinction between team technical performance and flight member performance? Were technical errors recognized and discussed throughout the debrief? Is the debriefing of technical performance accurate yet efficient? Were ways to improve provided to minimize errors in the future? Does the debrief include discussion of all relevant events that influenced the outcome/success of mission? Were concrete examples used to illustrate points?				

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional
C5. Technology mediated communication: consider the effectiveness of devices such as Smartboards and video-conferencing, during distributed meetings.				
Time spent addressing technical problems negatively affected understanding mission plan or lessons learned. Remote participants did not receive the same information as local participants. Interaction with devices distracted from the goal of the meeting.	Some time was spent addressing technical difficulties. Had to wait for remote participants to receive information. Poor transitions between briefings due to technical difficulties.	Some time was spent addressing technical difficulties. Local and remote participants received the same information. Incorporates some devices into mission execution plan.	The use of the devices did not distract from the meeting. Similar experience as an "in person" meeting. Integrates many additional devices into the mission execution plan.	Remote participants had same level of input/interaction as local participants. Devices were seamless used in the presentation. Devices used in the meeting was optimal for the presentation of the mission execution plan
Look for: Could you identify all air crew participating at the remote sites? Could you tell if remote people could be interrupted? Could you tell when remote participants were ready to continue to the next topic of the briefing? Was there a need for private communication with participants at a remote site? Was the transition between briefings seamlessly accomplished?				

1. Poor	2. Marginal	3. Standard	4. Very Good	5.Exceptional
C0. Overall Debriefing Behaviour				
Observed debriefing behaviours were significantly below expectations.	This level of proficiency is less than desired for effective coordination during the mission. There is room for much improvement.	The demonstrated behaviour promoted and maintained coordination and mission operations effectiveness. This is the minimum standard level of proficiency that should be expected during this mission.	Observed debriefing behaviours were significantly above expectations.	Behaviours represent a high level of skill in the application of specific behaviours, and serves as a model for coordination, teamwork and highly efficient mission operations.

Annex B Data Tables

There are two Excel data files supporting this report: CSCW data tables are located using this file path:

CSCW Data Tables

CSCW detailed phase data can be located in the individual mission excel files using this path:

CSCW Phase Data

The CSCW Data Tables includes several individual sheets. These sheets are described below.

S1. Turn_Operator

Session

INTB = initial brief

MB = mass brief

MD = mass debrief

MIDCORD = mid coordination brief

FINALCORD = final coordination brief

STMD = Strikers and Transport mass debrief

Participant

P with a number or letter identifies a participant. P7 represents technical support and P10 represents all participants laughing.

Turn Type

S = speech

C = computer use (primarily power point operator facilitating presentation display)

Overlap

O = overlap

An overlap identifies when a participant who is engaged in a speaking turn is talked over by another participant

Turn Length

Number of seconds a participant's turn lasts. Speaking turn is defined when a participant initiates a verbal utterance followed by silence.

Overlapped By

Overlapped By identifies what participant commits an overlap against another participant.

S2. Transition Count

C = computer use (action on operator computer)

I = introduction (when presenter introduces next presentation speaker)

Q = question (question asked by participant)

RC = role call (name called out and participant answers “here”)** not used in report

T = thank you (presentation moderator sometimes thanked individual presenters)

W = welcome (incorporated into I for reporting purposes)

S3. Transition

Refer to spreadsheet “Turn_Operator” and “Transition Count” for definitions

S4. Active Participant Pivot

Refer to spreadsheet “Turn_Operator” and “Transition Count” for definitions

S5. Active Participants

Room

1 = upstairs SERF room

2 = downstairs SERF room

S6. Tool Frequency Count

C = computer

P = Polycom system

PR = printer

SB = SMARTboard

S7. Breakdowns

Breakdown Type

U = user error

LOE = lack of operating experience

S = software malfunction/issue

S8. Percentile

Denotes the average ‘short’ turn, the average ‘medium’ turn, and the average ‘long’ turn, as well as the maximum and minimum turn lengths and the most common duration of turn.

S9. Overlap

A pivot table describing who was talked over by whom, how many times. Refer to "Turn Operator" for definitions.

S10. Number of Turns

A pivot table describing the number turns each participant had during briefings for each mission. Refer to "Turn Operator" for definitions.

S11. Tools Freq Pivot

A pivot table describing the number of times each tool was used during briefings for each mission. Refer to "Tool Frequency Count" for definitions.

S12. Tools

Raw data regarding tool usage. Refer to other sheets for definitions.

S13. Number of Breakdowns

A pivot table describing the number of breakdowns in the briefings for each mission.

The CSCW Phase Data contains the raw data describing each participants' turns. The first column (Participant) denotes the participant (use "Turn Operator" for definitions), and the second and third columns denote the start and end of that person's turn.

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J. Bennett; T. M. Lamoureux

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(U) The Coalition Mission Training Research (CMTR) Computer−Supported, Collaborative Work (CSCW) system allows geographically separated participants to collaborate during mission planning and briefing/debriefing. Collaboration within the CMTR environment is focused on facilitating task−oriented communication among team members. The opportunity was taken to conduct a video analysis and questionnaire survey of participants in a distributed briefing and debriefing environment during the Maple Skies simulation training event. The video analysis focused on behaviours exhibited by participants such as how many turns they had, how long each phase of the briefing lasted, collaborative tool use, gestures, and interruptions. The questionnaire survey solicited a participant's feelings on how well the collaborative tools facilitated the distributed briefings and debriefings. The results of these investigations are reported and recommendations for future development of this work are made.

14. KEYWORDS, DESCRIPTORS or IDENTIFIERS (Technically meaningful terms or short phrases that characterize a document and could be helpful in cataloguing the document. They should be selected so that no security classification is required. Identifiers, such as equipment model designation, trade name, military project code name, geographic location may also be included. If possible keywords should be selected from a published thesaurus, e.g. Thesaurus of Engineering and Scientific Terms (TEST) and that thesaurus identified. If it is not possible to select indexing terms which are Unclassified, the classification of each should be indicated as with the title.)

(U) computer−supported, collaborative work (CSCW); mission briefing/debriefing